

Table I-9 Physical/Chemical/Biological Parameters Measured in Twenty Station Sediment Data Analysis

Analyte	Type of Data	Value
Mean Percent Survival	Biological	Survival
Toxicity Equivalent	Biological	Response
AVS Conc	Physical	Measure
Total SEM - AVS	Physical	Difference
Antimony	Metal	Concentration
Arsenic	Metal	Concentration
Barium	Metal	Concentration
Beryllium	Metal	Concentration
Cadmium	Metal	Concentration
Calcium	Metal	Concentration
Chromium	Metal	Concentration
Copper	Metal	Concentration
Lead	Metal	Concentration
Manganese	Metal	Concentration
Mercury	Metal	Concentration
Nickel	Metal	Concentration
Selenium	Metal	Concentration
Silver	Metal	Concentration
Thallium	Metal	Concentration
Tin	Metal	Concentration
Vanadium	Metal	Concentration
Zinc	Metal	Concentration
LALK	Organic	Concentration
Petrogenic PAH	Organic	Concentration
Pyrogenic PAH	Organic	Concentration
TALK	Organic	Concentration
Total PAH	Organic	Concentration
Total S/T	Organic	Concentration
TPHC	Organic	Concentration
Aluminum	Physical	Percent
Clay	Physical	Percent
Iron	Physical	Percent
Magnesium	Physical	Percent
Potassium	Physical	Percent
Sand	Physical	Percent
Silt	Physical	Percent
Total Organic Carbon	Physical	Percent
Depth	Physical	Measure

Table I-10 Correlations between Biological Parameters and Physical/Chemical Sediment Parameters in Twenty Station Sediment Data Analysis

(.05>z>.01 = *; .01>z>.001 = **; z<.001 = ***)

Parameter	Associated Parameter	Pearson's Correlation	z	Significant	r-Square
Mean Pct Survival	Antimony	-0.6827	0.0009	***	0.4661
Mean Pct Survival	Barium	-0.5386	0.0143	*	0.2900
Mean Pct Survival	Beryllium	-0.6586	0.0016	**	0.4337
Mean Pct Survival	Cadmium	-0.6935	0.0007	***	0.4809
Mean Pct Survival	Calcium	0.6061	0.0046	**	0.3673
Mean Pct Survival	Chromium	-0.5814	0.0072	**	0.3381
Mean Pct Survival	Clay	-0.5454	0.0437	*	0.2975
Mean Pct Survival	Copper	-0.5380	0.0144	*	0.2894
Mean Pct Survival	Iron	-0.6723	0.0012	**	0.4520
Mean Pct Survival	Lead	-0.7014	0.0006	***	0.4920
Mean Pct Survival	Magnesium	-0.6631	0.0014	**	0.4398
Mean Pct Survival	Manganese	-0.4484	0.0474	*	0.2011
Mean Pct Survival	Nickel	-0.6348	0.0026	**	0.4030
Mean Pct Survival	Sand	0.7224	0.0035	**	0.5219
Mean Pct Survival	Silt	-0.5894	0.0266	*	0.3474
Mean Pct Survival	Thallium	-0.5081	0.0222	*	0.2581
Mean Pct Survival	Tin	-0.6535	0.0018	**	0.4270
Mean Pct Survival	Total Organic Carbon	-0.6096	0.0043	**	0.3716
Mean Pct Survival	Vanadium	-0.6569	0.0017	**	0.4315
Mean Pct Survival	Zinc	-0.7859	0.0000	***	0.6177
Mean Pct Survival	depth	-0.4765	0.0337	*	0.2270
Toxicity Equivalent	Clay	0.6322	0.0153	*	0.3997
Toxicity Equivalent	LALK	0.5043	0.0234	*	0.2543
Toxicity Equivalent	Magnesium	0.5128	0.0208	*	0.2629
Toxicity Equivalent	Petrogenic PAH	0.6894	0.0008	***	0.4753
Toxicity Equivalent	Selenium	0.6596	0.0016	**	0.4350
Toxicity Equivalent	Total Organic Carbon	0.5266	0.0171	*	0.2773
Toxicity Equivalent	Total PAH	0.6830	0.0009	***	0.4665
Toxicity Equivalent	depth	0.4943	0.0267	*	0.2444
AVS Conc	Chromium	0.4686	0.0372	*	0.2196
AVS Conc	Mercury	0.6987	0.0006	***	0.4881
AVS Conc	Pyrogenic PAH	0.4963	0.0260	*	0.2463
AVS Conc	Silver	0.5642	0.0096	**	0.3183
AVS Conc	TPHC	0.5689	0.0089	**	0.3236
Total SEM - AVS	Mercury	-0.6751	0.0011	**	0.4558
Total SEM - AVS	Pyrogenic PAH	-0.4789	0.0326	*	0.2294
Total SEM - AVS	Silver	-0.5253	0.0174	*	0.2759
Total SEM - AVS	TPHC	-0.5494	0.0121	*	0.3018

Table I-11 Correlations between Biological Parameters and Physical/Chemical Sediment Parameters Percentage Parameters Arcsine Square Root Transformed in Twenty Station Sediment Data Analysis

(.05>z>.01 = *; .01>z>.001 = **; z<.001 = ***)

Parameter	Associated Parameter	Pearson's Correlation	z	Significant	r-Square
Mean Pct Survival	Antimony	-0.7068	0.0005	***	0.4996
Mean Pct Survival	Barium	-0.5717	0.0084	**	0.3269
Mean Pct Survival	Beryllium	-0.6695	0.0012	**	0.4482
Mean Pct Survival	Cadmium	-0.6837	0.0009	***	0.4674
Mean Pct Survival	Calcium	0.6558	0.0017	**	0.4301
Mean Pct Survival	Chromium	-0.6075	0.0045	**	0.3690
Mean Pct Survival	Clay	-0.5369	0.0478	*	0.2882
Mean Pct Survival	Copper	-0.5833	0.0069	**	0.3403
Mean Pct Survival	Iron	-0.7002	0.0006	***	0.4903
Mean Pct Survival	Lead	-0.7375	0.0002	***	0.5439
Mean Pct Survival	Magnesium	-0.6937	0.0007	***	0.4812
Mean Pct Survival	Manganese	-0.4677	0.0376	*	0.2187
Mean Pct Survival	Nickel	-0.6594	0.0016	**	0.4348
Mean Pct Survival	Sand	0.7645	0.0015	**	0.5844
Mean Pct Survival	Silt	-0.6010	0.0230	*	0.3611
Mean Pct Survival	Thallium	-0.5437	0.0132	*	0.2956
Mean Pct Survival	Tin	-0.6970	0.0006	***	0.4858
Mean Pct Survival	Total Organic Carbon	-0.5741	0.0081	**	0.3296
Mean Pct Survival	Vanadium	-0.6981	0.0006	***	0.4874
Mean Pct Survival	Zinc	-0.8167	0.0000	***	0.6670
Mean Pct Survival	depth	-0.4750	0.0343	*	0.2256
Toxicity Equivalent	Clay	0.6108	0.0203	*	0.3731
Toxicity Equivalent	LALK	0.5043	0.0234	*	0.2543
Toxicity Equivalent	Magnesium	0.5050	0.0232	*	0.2550
Toxicity Equivalent	Petrogenic PAH	0.6894	0.0008	***	0.4753
Toxicity Equivalent	Sand	-0.5328	0.0498	*	0.2838
Toxicity Equivalent	Selenium	0.6596	0.0016	**	0.4350
Toxicity Equivalent	Total Organic Carbon	0.5428	0.0134	*	0.2946
Toxicity Equivalent	Total PAH	0.6830	0.0009	***	0.4665
Toxicity Equivalent	depth	0.4943	0.0267	*	0.2444
AVS Conc	Chromium	0.4686	0.0372	*	0.2196
AVS Conc	Mercury	0.6987	0.0006	***	0.4881
AVS Conc	Pyrogenic PAH	0.4963	0.0260	*	0.2463
AVS Conc	Silver	0.5642	0.0096	**	0.3183
AVS Conc	TPHC	0.5689	0.0089	**	0.3236
Total SEM - AVS	Mercury	-0.6751	0.0011	**	0.4558
Total SEM - AVS	Pyrogenic PAH	-0.4789	0.0326	*	0.2294
Total SEM - AVS	Silver	-0.5253	0.0174	*	0.2759
Total SEM - AVS	TPHC	-0.5494	0.0121	*	0.3018

Table I-12 Fish Tissue Parameters Examined

Independent Variables		Dependent Variables	
Organic Compound	Metal	Biological Measures on Composites	Biological Measures on Individuals
Acenaphthene	Aluminum	Benzo[a]pyrene Equivalent	gill epithelium
Acenaphthylene	Antimony	Toxicity Equivalent	gill pillar cells
Anthracene	Arsenic		gill vascular endothelium
Benzo[a]anthracene	Barium		hepatocytes
Benzo[a]pyrene	Beryllium		kidney tubules
Benzo[b]fluoranthene	Cadmium		kidney vascular endothelium
Benzo[e]pyrene	Chromium		liver bile duct
Benzo[g,h,i]perylene	Chrysene		liver vascular endothelium
Benzo[k]fluoranthene	Copper		Length
Biphenyl	Iron		
C1-Chrysenes	Lead		
C1-Dibenzothiophenes	Manganese		
C1-Fluoranthenes/pyrenes	Mercury		
C1-Fluorenes	Selenium		
C1-Naphthalenes	Silver		
C1-Phenanthrenes/anthracenes	Thallium		
C2-Chrysenes	Tin		
C2-Dibenzothiophenes	Vanadium		
C2-Fluoranthenes/pyrenes	Zinc		
C2-Fluorenes			
C2-Naphthalenes			
C2-Phenanthrenes/anthracenes			
C3-Chrysenes			
C3-Dibenzothiophenes			
C3-Fluoranthenes/pyrenes			
C3-Fluorenes			
C3-Naphthalenes			
C3-Phenanthrenes/anthracenes			
C4-Chrysenes			
C4-Naphthalenes			
C4-Phenanthrenes/anthracenes			
Chrysene			
Dibenzo[a,h]anthracene			
Dibenzothiophene			
Fluoranthene			
Fluorene			
Indeno[1,2,3-c,d]pyrene			
Naphthalene			
Perylene			
Phenanthrene			
Pyrene			

**Table I-13 Correlations between Biological Parameters and Tissue Chemical Parameters;
All Fish Considered (.05>z>.01 = *; .01>z>.001 = **; z<.001 = ***)**

Parameter	Associated Parameter	Pearson's Correlation	z	Significant	r-Square
kidney tubules	Acenaphthene	-0.716	0.020	*	0.512
kidney tubules	C1-Naphthalenes	-0.832	0.003	**	0.692
kidney tubules	Antimony	-0.646	0.043	*	0.418
kidney vascular endothel	Iron	-0.744	0.014	*	0.554
length	Iron	-0.781	0.008	**	0.611
length	Mercury	0.883	0.001	***	0.779
length	kidney vascular endothel	0.778	0.008	**	0.605
Toxicity Equivalent	Naphthalene	0.874	0.000	***	0.764
Toxicity Equivalent	Pyrene	0.590	0.034	*	0.348
Toxicity Equivalent	Benzo[a]pyrene Equivalent	0.991	0.000	***	0.982

Table I-14 Results of Chemical and Biological Parameters for Fish Tissues Using Student-Newman-Keuls Test

Significant GLMs - All Fish							
Analyte	Degrees of Freedom	Sum of Squares	F	Probability	Zone 0 (SNK)	Zone 2 (SNK)	Zone 3 (SNK)
Arsenic	2	882.62	11.6668	0.0024	B	A	B
Benzo[a]pyrene Equivalent	2	2.13	21.8967	0.0002	B	A	B
Dibenzothiophene	2	0.00	58.2586	0.0000	C	B	A
Naphthalene	2	0.00	8.4092	0.0072	B	A	AB
Toxicity Equivalent	2	0.01	19.9730	0.0003	B	A	B
Significant GLMs - Halibut Only							
Arsenic	2	463.89	16.2029	0.0065	B	A	AB
Benzo[a]pyrene Equivalent	2	1.21	7.8125	0.0289	A	A	A
C1-Naphthalenes	2	0.00	6.8635	0.0368	A	A	A
C1-Phenanthrenes/anthracenes	2	0.00	7.7258	0.0296	B	B	A
Thallium	2	0.00	6.1029	0.0455	A	A	A
Toxicity Equivalent	2	0.00	6.5128	0.0405	A	A	A
kidney tubules	2	11.35	13.5252	0.0096	A	B	A
Significant GLMs - Halibut Only with Length as Covariant							
Arsenic	2	399.19	13.4500	0.0168	B	A	AB
Benzo[a]pyrene Equivalent	2	1.38	14.2000	0.0152	B	A	AB
C1-Naphthalenes	2	0.00	10.1300	0.0272	A	A	A
Thallium	2	0.00	15.7500	0.0127	B	A	AB
Toxicity Equivalent	2	0.00	9.7400	0.0290	A	A	A
kidney tubules	2	10.31	9.9700	0.0279	A	A	A

GLM = General Linear Model (e.g., Student-Newman-Kuels Test)

Table I-15 Results of Biological Parameters for Tissues Using Student-Newman-Kuels Test

Analyte	Degrees of Freedom	Sum of Squares	F	Probability	Zone 0 (SNK)	Zone 2 (SNK)	Zone 3 (SNK)
Significant GLMs - Halibut Only P450 Data Set							
kidney tubules	2	20.4915	7.5655	0.0059	A	B	AB
Significant GLMs - Halibut Only Sex as Covariant							
kidney tubules	2	21.3135	11.7592	0.0024	A	B	A
Significant GLMs - Halibut Only Length as Covariant							
kidney tubules	2	21.7300	11.9562	0.0029	A	B	A
length	1	3405.2300	84.6738	0.0000	A	A	A
Significant GLMs - Halibut Only Sex and Length as Covariant							
kidney tubules	2	19.6100	6.8420	0.0093	A	B	AB
kidney vascular endothelium	2	59.5600	3.9780	0.0449	A	A	B
length	1	4644.5600	152.7610	0.0000	B	A	A

GLM = General Lineral Model (e.g., Student-Newman-Kuels Multiple Range Test)